RULES

FOR THE

OPENING OF A RAILWAY

OR SECTION OF A RAILWAY

FOR THE

PUBLIC CARRIAGE OF PASSENGERS.

ISSUED BY THE GOVERNMENT OF INDIA.

1893.

Corrected to

31st December 1904.

INDEX.

Forms for Tabulated Details, etc.

I.—Arrangements for opening.

RULES FOR THE OPENING OF A RAILWAY
OR SECTION OF A RAILWAY
FOR THE
PUBLIC CARRIAGE OF PASSENGERS.

(Corrected to 31st December 1904.)

The following rules are supplementary to the provisions of Chapter IV of the Indian Railways Act (Act IX of 1890).

I.—ARRANGEMENTS FOR OPENING.

1. Action to be taken by Manager *—

(*a*) When it is intended to open a railway for the public carriage of passengers, notice of such intention is to be communicated, through the usual channel, to the Governor General in Council and to the Inspector by the Manager, at least one month before the date on which it is desired that the inspection shall take place.†

(*b*) The Manager will at the same time supply the Inspector with a copy of the notification in the *Gazette of India* applying the general rules made under Section 47 of the Indian Railways Act for regulating the working of the railway,‡ and the documents prescribed in Section 3 below.

(*c*) The Manager will be responsible that the railway is in every respect fit for opening by the date fixed for inspection.

2. Action to be taken by Inspector—

The Inspector will, in communication with the Manager, fix a date for the inspection and decide on any special arrangements to be made beforehand to facilitate the work.

3. Documents to be furnished—

The following documents are to be furnished by the Manager to the Inspector at least one month before the date by which the railway is expected to be ready for opening:—

(*a*) Tabulated Details.
(*b*) Index Plan and Section of Railway.
(*c*) Drawings of Works.
(*d*) List of questions and answers. §
(*e*) Certificates. §
(*f*) List of infringements of Standard Dimensions.
(*g*) Diagram of proposed testing train. §

These documents should be signed by the Manager and should be prepared in accordance with the following instructions, and will accompany the inspection report when sent in to the Government of India for disposal.

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* Manager means the responsible officer in charge of the railway for the time being, whether Agent, General Manager, Engineer-in-Chief, or other officer.

† In special cases, under Section 17 (2) of the Railway Act, the length of time for this notice may be reduced, or the notice may be dispensed with altogether. See also Chapter VI, Section 1.

‡ Where the rules differ from the General Rules sanctioned by the Government of India for use on State Railways, a copy of all additions or alterations made to these general rules should be supplied to the Inspector.

§ The documents referred to in (*d*), (*e*) and (*g*) should be prepared, in the first instance, by the Chief Officer of the Agency which *constructed* the new railway; they should then be carefully scrutinised by the Government Inspector in the course of his inspection, and any corrections found necessary should be carried out; and the documents should be countersigned by both the Government Inspector and the Chief Officer of the Agency which will *work* the new railway before their submission to the Government of India.

I.—Arrangements for opening.

Throughout these documents all distances given are to be reckoned from the same 'Fixed Point,' and, unless otherwise specified, are to be in miles and decimals (to two places). In the case of a railway in through communication with a seaport, the fixed point should be at the end nearest to that seaport. For a branch line the fixed point should generally be the same as that adopted for the main line. The position of the fixed point is to be clearly defined by a note on the Plan and Section sheets, and this note is to be repeated where required on the 'Tabulated Details' and other documents.

The datum adopted is to be 'Mean Sea Level,' and all heights are to be referred to this datum in feet and decimals.

(*a*) *Tabulated Details.*—Tabulated details of the more important characteristics of the railway and of its equipment as follows:—

(i) Curve Abstract
(ii) Gradient Abstract
(iii) Bridge Abstract
(iv) Important Bridges—Particulars of waterway and construction
(v) Ballast and Permanent-way
(vi) List of Stations, Station Buildings, etc.
(vii) List of Staff Quarters and of rents obtainable thereon
(viii) Station Machinery

to be prepared in accordance with Forms I—VIII (pages 23—30).

(*b*) *Plan and Section of Railway.*—An index plan and section of the railway to a scale of one mile to one inch horizontal, and one hundred feet to one inch vertical, showing formation level, and all gradients.

(*c*) *Drawings of Works.*—Drawings to illustrate the design and mode of construction adopted, if called for by the Inspector, more particularly for girders not of the usual type.

(*d*) *List of Questions and Answers.*—The list of questions and answers will be prepared in accordance with Form IX (page 31).

(*e*) *Certificates.*—Certificates with regard to the following points:—

(i) Standard Dimensions
(ii) Strength of Bridges
(iii) Wheel Loads
(iv) Continuous foot-boards
(v) Accommodation for Third Class passengers
(vi) System of working

to be prepared in accordance with Form X (page 37).

(*f*) *List of infringements of Standard Dimensions.*—The list of infringements of Standard Dimensions will be prepared in Form XI (page 38): full details for each case must be given, with explanation of the necessity for such infringement and a reference to the authority under which it was permitted.

(*g*) *Diagram of Testing Train.*—A diagram to a scale of $\frac{1}{4}$ inch to a foot, showing the distances between the wheels and the total load on each pair of wheels of the proposed testing train.

II.—DUTIES OF INSPECTOR.

1. General Instructions—

(*a*) The Inspector should carefully examine and enquire into all matters which may appear to him necessary to satisfy himself that the safety of the travelling public and of the servants of the railway has, as far as practicable, been secured ; that general rules have been applied ; that the 'Standard Dimensions' have everywhere been properly observed ; and that the works, structures, rolling-stock and appliances belonging to the railway are not only in a proper state when inspected, but are also designed and carried out in such a manner as may, so far as practicable, guard against accident or failure.

(*b*) The Inspector should, moreover, so far as practicable, satisfy himself that the accommodation works provided for the public, or for owners or occupiers of property adjacent to the railway, are sufficient and suitable for the purpose.

(*c*) The Inspector should also make enquiries as to the arrangements proposed for connecting railway stations with traffic marts.

(*d*) In applying these "Rules" to the inspection of "Light Railways" it should be remembered that safety is entirely a relative matter depending upon several factors, of which speed is the most important, and that in the case of lines of narrow gauges and of lines intended for light traffic, it is for the Government Inspector to prescribe such limits of speed and other working conditions as will, in his judgment, secure the necessary safety. Similarly, he should in such cases adopt a standard of convenience for the travelling public in accordance with the special conditions, rather than that of a fully equipped trunk railway.

2. Special points requiring attention—

The attention of the Inspector is specially directed to the list of questions and answers in Form IX (page 31) From the answers given, he should notice if the points enumerated in the form of questions, have been duly observed by the Railway authorities. It is, however, open to the Senior Government Inspector of the Circle, in the exercise of his discretion, to enforce or modify the requirements according to the circumstances of each case.

3. Tests of Girders—

(*a*) In the course of the inspection of a railway with a view to its being opened for public traffic certain selected girders are to be tested for deflection and oscillation in accordance with the instructions given below.

The spans to be tested are as follows:—

(i) For spans up to and including 60 feet, at least one span of each different pattern or type of girder.

(ii) For larger spans, at least one span of each bridge.

The Inspector may, at his discretion, test any number of spans in addition to the minimum specified above, and may test a span any number of times he may consider desirable.

(*b*) For testing any span the testing train should, where practicable, be of such a length that its total wheel base may be somewhat greater than the length of the span. The testing train should be made up of two engines (with their tenders if tender engines are used) coupled either head to head or in the ordinary way. Should two engines not give a train of sufficient length the additional length required is to be made up by wagons, The engines are to be in steam, and the wagons are to be fully loaded, and both engines and wagons should be of the heaviest type on the line.

II.—Duties of Inspector.

(*c*) The following tests for deflection and oscillation are to be applied :—

(i) The test train to be run slowly on to the span, and be brought to rest in such a position as to bring the heaviest stress on the girders. The train to remain at rest in this position for one minute, and then to be moved on slowly clear of the span.

(ii) The test train to be run over the span at a speed of at least 30 miles an hour on the 5′ 6″ gauge, or 20 miles an hour on the metre gauge.

When possible it should always be ascertained and reported, with reference to test (i), whether the girder has previously been subjected to load or not, and if so, how the said load compared with that now used for these tests. For the high speed test (ii) the wagons, if any, must always be pulled and not pushed by the engines, and the composition of the train must be the same as in the first test.

(*d*) In each case both deflection and oscillation are to be observed and recorded, and in case of girders of 60 feet span and over, this should be done for both top and bottom booms of the girder. In the case of through bridges with cross girders, it is desirable, when practicable, to observe the lateral deformation of both top and bottom booms simultaneously at corresponding points of both girders under the steady load, in order to judge of the degree of *encastrement* of the cross girders. Where practicable, some self-acting recording apparatus should be employed.

(*e*) For each bridge tested the Inspector should, moreover, examine the design generally, and satisfy himself, so far as practicable, that the different portions of the structure are properly designed for the work they are intended to perform, that the work in the construction and erection of the girders has been properly executed, and that the whole structure has been made and put together in a proper and workmanlike manner. He should also see that the girders are provided with a proper system of wind bracing and, in the case of girder bridges on which the road is carried on timbers resting directly on the main girders, that the latter are sufficiently braced together independently of the sleepers.

(*f*) Should the Inspector see cause to believe that any riveting has been improperly or inefficiently executed, he may, at his discretion, have any rivets cut out for examination. He may also have any part of the structure removed or taken to pieces for more detailed inspection, should he consider this necessary to satisfy himself regarding the quality and character of the work.

(*g*) The following documents and information regarding the bridge tests will accompany the inspection report submitted by the Inspector :—

(1) A diagram, drawn to a scale of ½ inch to a foot, showing the position of the centre of each axle of the testing train. On the diagram is to be figured the load in tons and decimals on each pair of wheels,* the distance apart, centre to centre, from each axle to the next throughout the train, and the wheel base of the whole train.†

(2) A list of spans tested, noting in each case the name or number of bridge, size of span, number of spans in bridge, description of girder, number of spans selected for test, the deflection, oscillation and other results of test in Form XII (page 39).

4. Recommendations to be intimated to Manager—

(*a*) The Inspecting Officer should, during his inspection, intimate to the Manager the general tenor of the recommendations he intends to make, in order to afford that officer the opportunity of discussing with him the various points raised. He may also furnish the Manager with a copy of his report, or extracts therefrom, making it clear at the same time that the line cannot be opened without proper sanction in accordance with the terms of the Railway Act.

(*b*) Any objections or explanations, which the Manager may desire to record, should be duly noted by the Inspector to be brought forward in the Inspection report.

* This load is to be the *gross* load, including the weight of the wheels, axles, axle-boxes, and springs.

† See Chapter I, Section 3 (*g*).

III.—DUTIES OF MANAGER.*

1. Information to be supplied and assistance rendered—

(*a*) Before the inspection, it will be the duty of the Manager * to ascertain from the Inspector what special arrangements, if any, are required; to see that such special requirements are duly provided for, and that proper arrangements are made to facilitate, so far as practicable, the work of inspection, testing bridges, etc. The Manager will also be responsible that, by the date fixed for the inspection, the railway is in every respect fit for opening.

(*b*) It will be the duty of the Manager to point out, and bring to the notice of the Inspector, any defects in design, material or construction, on the works, rolling-stock, or appliances of the railway. Also any instances in which the Standard Dimensions have not been observed.

(*c*) During the inspection the Manager will afford the Inspector all information and assistance in his power, and provide all instruments and apparatus required for making measurements, testing bridges, etc.

(*d*) Should the Inspector desire any work to be taken to pieces, or any portion of a structure to be removed with a view to making a more complete examination of the details or workmanship, the Manager will at once arrange to meet the wishes of the Inspector as quickly and completely as practicable.

2. Railway officers to accompany Inspector—

(*a*) A responsible officer, and in the case of State lines the Manager, should accompany the Inspector throughout the inspection unless prevented by some unavoidable cause. Should the Manager be unable to be present during the inspection, he should be represented by one of the senior officers of the railway specially delegated for the purpose; and all information supplied or engagements entered into by such officer will be held to bear the authority of the Manager.

(*b*) During the inspection of each district or division of the railway, the Engineer or other officer who has been in immediate charge of that portion of the line during construction should also be present, if possible.

(*c*) An Assistant Engineer or intelligent subordinate should be placed in charge of the bridge testing arrangements.

* Manager means the responsible officer in charge of the railway for the time being, whether Agent, General Manager, Engineer-in-Chief, or other officer.

IV.—THE INSPECTION REPORT.

1. Nature of Report—

(*a*) The Inspection Report should be clear and concise, dealing only with such matters as may require to be brought to notice as referred to in Chapter II. Subjects to which attention is directed should, so far as practicable, be taken up in the order adopted in Form IX (page 31). It should be particularly noticed whether the line generally has been designed for Standard Loads. If the Standard Dimensions have in any instances been infringed, a list of such infringements should be submitted in Form XI (page 38), and each case should be clearly stated with a distinct expression of opinion as to whether or not the infringement should be allowed to pass.

(*b*) Any objections raised or explanations given by the Manager should be noted.

(*c*) In conclusion the Inspector should definitely recommend one of the following courses, see Section 19 of the Indian Railways Act IX of 1890:—

(i) That the railway be opened unconditionally at once.

(ii) That the railway be opened at once, subject to certain stated restrictions.

(iii) That the opening of the railway be postponed, until certain stated conditions are fulfilled.

2. Documents to accompany Report—

The following documents, as specified in Chapter I, Section 3, are to accompany the inspection report:—

(*a*) Tabulated details (Forms i to viii).

(*b*) Index Plan and Section of Railway.

(*c*) Drawings of works.

(*d*) List of questions and answers (Form ix).

(*e*) Certificates by Manager (Form x).

(*f*) List of infringements of Standard Dimensions (Form xi).

(*g*) Diagram of testing train.

(*h*) Results of bridge tests (Form xii).

3. Submission to the Government of India—

The Inspection Report is to be sent by the Inspector to the Government of India for disposal, and should be submitted as early as practicable after the inspection has taken place. It is to be remembered that every day by which the report is delayed involves a loss to the Railway Administration of the receipts for a day's traffic.

4. Report required in all cases—

The foregoing instructions regarding the preparation and submission of the Inspection Report are to be carried out in *all* cases, whether the Inspector is authorized to open the Railway on his own responsibility or not.

V.—SANCTION TO OPEN THE RAILWAY.

1. Sanction necessary for opening—

(*a*) A railway, or portion or extension of a railway, may not be opened for the public carriage of passengers until the sanction of the Governor General in Council has been given to the opening, after inspection, in accordance with the foregoing rules. *

(*b*) In special cases the Governor General in Council may delegate to an Inspector authority to open the railway on his own responsibility immediately after inspection. In such cases, however, the sanction to open given by the Inspector will be provisional and will be subject to the confirmation of the Governor General in Council and to any restrictions or conditions the Governor General in Council may, after receipt of the Inspection Report, think fit to impose.

(*c*) It is to be understood that, unless the Inspector is specially authorised to open the railway, it will, in every case, be necessary that the complete report properly drawn up in accordance with the foregoing rules shall be submitted to the Governor General in Council *before* sanction to the opening can be given. A report by telegram is not sufficient for this purpose, even though the Inspector may himself be quite satisfied that the railway is fit for opening.

2. Orders on Inspection Report—

(*a*) As a rule, the orders of the Governor General in Council on the Inspection Report will be given by telegram addressed to the Local Government or other authority under whose administration the railway may be placed. This telegram will be confirmed by a letter giving such detailed instructions as may appear necessary.

(*b*) A list of code words which have been authorised for use in such telegrams is attached as Form XIV (page 41) for ready reference.

* See sections 18 and 19 of Indian Railways Act IX of 1890.

VI.—OPENING OF MINOR WORKS, DEVIATION LINES, TEMPORARY DIVERSIONS, ETC., ON EXISTING RAILWAYS.

1. Notice required—

When it is proposed to open deviation lines, stations, junctions and crossings on the level, or any alteration or reconstruction materially affecting the structural character of any work, and when the works named form part of, or are directly connected with, a railway used for the public carriage of passengers, and have been constructed after the inspection which preceded the first opening of the section of railway in which they are situated, only such notice will be required from the Railway Administration, in lieu of the notice prescribed in Chapter I, Section 1, as may be demanded by the Inspector concerned.

2. Powers of Inspectors to open Minor Works, etc.—

(*a*) Power is conferred on the Inspector to dispense with the notice required under section 17 (1) of the Indian Railways Act, 1890, and to sanction, without previous report under section 19, the opening for passenger traffic of the following works, when forming part of, or directly connected with, a railway used for the public carriage of passengers, if he is satisfied, either with or without inspection, that the provisions, (*b*), (*c*) and (*f*) of sub-section (1) of section 19 of the Act have been duly fulfilled :—

(i) Temporary diversions,* including temporary bridges and their approaches.

(ii) New bridges or extensions of existing bridges on a line already opened.

(iii) Any interlocking apparatus to be used for working points over which passenger trains may run, or signals for the protection of passenger trains.

(iv) Any extensive alteration in the arrangements for signalling.

(v) Any station, or junction of a line used for passengers with another line, or any crossing on the level by means of a diamond crossing, of a line used for passengers, by another line.

Works so opened without inspection should be inspected at the earliest possible date.

(*b*) In all cases coming under the above rule, the Inspector will, on authorising the opening of the work, report the matter for the information of the Government of India. As a rule a very brief report, by telegram or otherwise, will suffice for this purpose ; and any further details which the Senior Government Inspector may consider necessary should be given in the next Inspection Report.

(*c*) In the case of minor works other than those named in paragraph 2 (*a*), the Inspector will exercise his discretion as to carrying out a subsequent inspection.

(*d*) The authority for opening any work of the kind referred to in rules (*a*), (*b*) and (*c*) shall be communicated *in writing* by the Inspector to the Railway Administration, and a list of the works so authorised during each half-year prepared in Form XIII (Page 40) shall be appended to the usual Inspection Report of the railway for that half-year with such further remarks as may be thought fit.

* NOTE.—Temporary diversions may, in cases of accident, be opened under section 21 of Indian Railways Act IX of 1890 on the responsibility of the Railway Administration ; but if the use of the temporary diversion is likely to be extended for more than three days, the Inspector should, if he considers it necessary, take the earliest possible opportunity of inspecting it.

VI.—Opening of minor works, etc., on existing Railways.

3. Powers of Inspectors to sanction infringements of certain Standard Dimensions—

(*a*) The several Senior Government Inspectors of Railways are delegated with power to sanction infringements of Standard Dimensions on open lines of railway under List B only of the revised schedules of Standard Dimensions to be observed on all 5′ 6″ and metre gauge railways in India prescribed under Government of India, Public Works Department, Circulars Nos. 8 Ry. and 9 Ry., dated 25th November 1896. A report of each such sanction, with explanation of its necessity, should be made to the Government of India, and a list of all such sanctions should be recorded in the next half-yearly Inspection Report of the railway concerned.

(*b*) No infringement of the Standard Dimensions in List A is to be permitted without the special sanction of the Governor General in Council, and it must therefore be understood that the power delegated to Senior Government Inspectors to sanction infringements of List B does not apply to items in which the dimensions under Lists A and B are identical. Nor does it apply to any of the maximum moving dimensions or standard weights of rolling stock (Chapter IV of Circulars Nos. 8 and 9 Ry. of 1896), any infringement of which must be referred for orders to the Government of India. Nor does it apply, without previous reference to the Government of India, to any infringements of Standard Dimensions incurred before the date of opening for public traffic, on a line under construction.

(*c*) No *new type* of engine or other rolling-stock which would cause excessive stresses in existing structures or track, may be ordered or brought into use until the particulars specified in rule 5 of Chapter VII of these rules have been submitted to, and scrutinised by, the Government Inspector, and forwarded by him, with his recommendations thereon, to the Government of India for orders.

VII.—RULES FOR THE DESIGN AND INSPECTION OF GIRDER BRIDGES.

1. General—

1. For calculations dealing with the strength of railway bridges of wrought iron or steel, and for the determination of the standard of working loads for which such bridges may be used, the following rules are to be adopted so far as they are applicable to the case; and in the event of any particular structure failing to come up to the standard here specified, the Senior Government Inspector should make a special recommendation as to whether the structure may be used and, if so, under what conditions.

2. Except under the special sanction of the Senior Government Inspector of Railways for the Circle concerned, no loadings may be imposed on any railway bridge of wrought iron or steel, which would cause in any member thereof stresses greater than those specified in these Rules.

3. Except under similar sanction, no railway bridge may be erected or re-opened for traffic after strengthening, unless it is able to carry, without exceeding the stresses specified in these Rules, the maximum loads specified in these Rules.

4. But in exceptional circumstances when a first class standard is not required, as in the case of economically constructed lines worked at low speeds or with axle-loads considerably below the normal, where girders below the standard demanded by these Rules are erected temporarily to expedite opening, or where standards have not been fixed and speeds are comparatively low (as in the case of gauges less than the metre), the Inspector may recommend a departure from these Rules on conditions to be specified by him, provided the calculations forwarded with his Report show that opening on such conditions will not be attended with danger to the public or the running staff.

5. Any Railway Administration which desires to use structures, track, or rolling-stock differing from the standards prescribed in these Rules, may apply for sanction to do so, and the proposals will be considered on their merits. The application must be accompanied by—

(*a*) Such diagrams, etc., as may be necessary to give full particulars of the weights and principal dimensions of the stock for which sanction is required.

(*b*) A certificate signed (or countersigned) by the principal Technical Adviser to the Administration, showing that the use of such stock (over such sections of the line, and under such conditions as he may see fit to specify) will not involve danger to the traffic or abnormal injury to existing structures or track.

(*c*) Such calculations, strain-sheets, etc., as may be necessary to show how the conclusion is arrived at, the stresses which the proposed stock will cause in the various girders over which it is to run, and the effects which the said stock will have on various structures or track as compared with those caused by stock already in use, or allowed by existing Government orders.

(*d*) An approximate estimate of the cost of such improvements, in existing structures or track, as the use of the proposed stock is likely to render necessary on the railway concerned, whether immediately or in the near future.

It is desired that the calculations, etc., submitted in support of such applications should, so far as practicable, follow the methods prescribed in these Rules, whether any other laternative method of calculation is adopted also or not.

These must be scrutinised by the Government Inspector, and his recommendations thereon submitted to the Government of India for orders, *before* the structures or rolling-stock of the modified standard proposed may be ordered or brought into use.

VII.—Rules for the Design and Inspection of Girder Bridges.

2. Maximum permissible Stress—

6. For any member of a railway bridge of wrought iron or steel the *total working load* is to be taken as the 'moving load' increased by an appropriate allowance for 'impact' added to the actual 'fixed load.'

7. For the purposes of this rule 'fixed load' is to be taken to mean the weight of the structure itself with the roadway, flooring, ballast, permanent-way, etc., complete. (*See also 'Wind Pressure,' page* 12.)

'Moving load' is to be taken as a train load on each line of rails as specified in Rule 15 below; and if there be a road or foot-way that can be occupied at the same time as the railway track, an additional moving load as specified in Rules 17 and 18 below.

8. The increment for Impact to be allowed in the case of railway load is to be calculated by the formula—

$$I = \frac{300}{L + 300} S$$

where S is the stress due to the train load specified, considered as at rest in the position which gives the maximum stress in the member under consideration, and L is the length in feet of that portion of the span which the train has had to traverse to reach that position from the point where it first began to produce stress in that member. I is the amount to be added to S to allow for Impact. Values of the ratio $\frac{I}{S}$ for various values of L are appended as Table I (page 14).

NOTE.—For *bending moments* caused by an assumed equivalent moving load, L may be taken as equal to the span of the girder. For *shears* it will usually be the distance of the point under consideration from the further support. For *cross-girder concentrations* it will usually be twice the interval between the cross girders.

9. The increment for Impact to be allowed in the case of loads moving on the roadway or foot-ways of a combined road and railway bridge, shall be half the railway increment specified in Rule 8 above.

10. The intensity per square inch of different kinds of stress due to the 'total working load,' thus calculated is not to exceed the following:—

	Wrt. iron.	Steel.	
Tension and Compression .	6 tons	8 tons	per sq. inch of effective area.
Shearing	4 „	5 „	ditto.
Bearing	9 „	11 „	ditto.

11. But for *occasional loads*, such as those due to wind pressure, or exceptional loadings of a separate roadway simultaneously with the absolute maximum train load, stresses 25 per cent. in excess of the above may be permitted.

NOTE.—*This implies that the effect of wind may be neglected when the stresses caused by it are not more than 25 per cent. of those caused by the "Total working load."*

12. For members *in tension* the working stress per square inch, given above, is to be taken on the *net* available area at the *weakest* part of the member of the structure to which it is applied, after deducting all holes for rivets, pins, bolts, etc.

13. For members *in direct compression* well filled rivet holes *need not* be deducted, but the working stress given above is subject to such reduction as may be necessary according to a suitable column formula. In calculations submitted to Government, the formula given in Table II (page 15) should preferably be used. No main compression member should have a greater free length than 100 times its least radius of gyration, but in subsidiary members, such as lateral struts, the ratio may be 120. For plate girders it will suffice if the compression flange has the same sectional area as the tension flange.

VII.—Rules for the Design and Inspection of Girder Bridges.

14. Members and connections subject to *alternating stresses* are to be proportioned for tension and compression separately, and half the smaller area is to be added to the larger area to give the total section.

3. Standard of permissible Trainload—

15. The maximum trainload referred to in Rules 3 and 8 above is the heaviest train of two engines, followed by as many fully loaded wagons as can get on the bridge, which will not cause in the girders greater bending moments, shears, and cross girder concentrations than those laid down in Tables III, IV, and V (pages 16, 17 and 18).

4. Road or Footway Loads—

16. For those members of a combined road and railway bridge which carry the roadway only, the moving load on the road or footway shall be taken as 90 lbs. per square foot (4 tons per 100 square feet) of effective surface, or the heaviest elephant, cannon, traction-eingne, vehicle or train of vehicles which is likely to be allowed on the same, whichever will give the greatest stress in the members.

17. But for those members which carry both loads, only 20 lbs. per square foot of effective surface need be taken, except in special cases where this moderate load would seem to be inadequate, such as a bridge at a large city the roadway of which is likely to be constantly crowded. Such cases should be treated on their merits. (*See also Rule* 9.)

18. Particulars of the weights and dimensions of various loads likely to traverse roads in India are given in Table VI (page 19).

5. Wind Pressure—

19. Every structure must be capable of bearing a wind pressure of 2·5 tons per 100 square feet (56 lb. per square foot) when *unloaded*, or 1·5 tons per 100 square feet (33·6 lb. per square foot), when *loaded* with the maximum moving load, without exceeding the stresses laid down *for occasional loads* in Rule 11 above.

20. The surface exposed by a loaded railway bridge is to be reckoned as follows :—

(i) A train surface calculated on a height of 10 feet 0 inch (*i.e.*, 0·15 tons per foot run) on the 5′ 6″ gauge, or 8 feet 4 inches (*i.e.*, 0·125 tons per foot run) on the metre gauge, multiplied by the total length of the girder.

(ii) The actual vertical surface (as seen in elevation) of those portions of one girder which may be below a line drawn 2 feet above rail level, and above a line drawn 12 feet above rail level on the 5′ 6″ gauge or 10 feet 4 inches on the metre gauge.

(iii) In the case of triangulated girders, the actual vertical surface (as seen in elevation) of that portion of the leeward girder which may be above or below the train surface specified above.

21. The total wind pressure thus calculated is to be provided for by a proper system of wind bracing or floor-plating, and its effect is to be taken into account as forming a part of the stress on the chords of main girders of more than 40 feet span. Proper arrangements must be made at the girder ends to secure sufficient stiffness to resist racking action.

22. No allowance for Impact is required for wind load, and the excess vertical load on the leeward rail due to a horizontal wind pressure tending to cant the train *need not* be taken into account. (*See also note to Rule 11.*)

VII.—Rules for the Design and Inspection of Girder Bridges.

6. Applicability of these rules to existing girders—

23. The rules given above are intended primarily for the guidance of Inspectors of Railways in their inspections of new railways or of new works on existing railways prior to opening; and no bridges which do not come up to the standard thus prescribed may be passed without restriction, except with the sanction of the Government of India, though it is open to the Inspector to make his recommendations as to whether such bridges may be used, and if so, under what conditions. (*See Rules 1 to 5 above.*)

24. The rules for 'maximum permissible stress' apply also to the investigation of the strength of existing girders; and it is desired that when such investigations are submitted to the Government of India, whether for new or old girders, the methods prescribed above shall invariably be adopted, whether any other alternative method of calculation is also employed or not. (*See Rule 5 above.*)

25. In applying these rules for working stress to existing girders under the actual loads of *existing engines*, the Government Inspector may, at his discretion, permit those girders to be used for public traffic with stresses exceeding the limits laid down herein, and subject to such restrictions of speed, marshalling, periodical inspection, or other conditions as may in his judgment be necessary in each case, but should report his action for the information of the Government of India. *No such permission should, however, be given unless the responsible officer of the railway concerned shall first have certified that such usage will not involve danger to the traffic nor abnormal injury to the existing structures.*

26. But if it is proposed to introduce a new type of engine or other rolling-stock, and it is found that the *proposed* rolling-stock will cause in existing girders stresses exceeding the limits laid down in these rules, the Senior Government Inspector should refer the matter to the Government of India, with his recommendations on the subject, *before* the engines or other rolling-stock are ordered. [*See also Rule 5 above, and Chapter VI, Section 3 (c).*]

27. Nothing in these Rules is to be held to limit the use of any girder ordered before the issue of Government of India, Public Works Department, Circular letter No. 1843 R. S., dated 21st December 1903, (publishing these Rules), and designed under the Rules promulgated in Government of India, Public Works Department, letter No. 1369 R. C, of 13th December 1892, or in Public Works Department Circular No. 6 Ry. of 7th September 1893, under conditions which would have been permitted had those rules remained in force.

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE I.

[Chapter VII, Rule 8.]

Coefficients of Impact for Train Load.

L=length in feet loaded to produce Maximum Stress in member under consideration.

L.	$\frac{300}{L+300.}$	L.	$\frac{300}{L+300.}$	L.	$\frac{300}{L+300.}$	L.	$\frac{300}{L+300.}$	L.	$\frac{300}{L+300.}$
5	0·984	31	0·906	57	0·840	83	0·783	145	0·674
6	0·980	32	0·904	58	0·838	84	0·781	150	0·667
7	0·977	33	0·901	59	0·836	85	0·779	155	0·659
8	0·974	34	0·898	60	0·833	86	0·777	160	0·652
9	0·971	35	0·896	61	0·831	87	0·775	165	0·645
10	0·968	36	0·893	62	0·829	88	0·773	170	0·638
11	0·965	37	0·890	63	0·826	89	0·771	175	0·632
12	0·962	38	0·888	64	0·824	90	0·769	180	0·625
13	0·968	39	0·885	65	0·822	91	0·767	185	0·619
14	0·955	40	0·882	66	0·820	92	0·765	190	0·612
15	0·952	41	0·880	67	0·817	93	0·763	195	0·606
16	0·949	42	0·877	68	0·815	94	0·761	200	0·600
17	0·946	43	0·875	69	0 813	95	0·759	210	0·588
18	0·943	44	0·872	70	0·811	96	0·758	220	0·577
19	0·940	45	0·870	71	0·809	97	0·756	230	0·566
20	0·937	46	0·867	72	0·806	98	0·754	240	0·556
21	0·935	47	0·865	73	0·804	99	0·752	250	0·546
22	0·932	48	0·862	74	0·802	100	0·750	260	0·536
23	0·929	49	0·860	75	0·800	105	0·741	270	0·526
24	0·926	50	0·857	76	0·798	110	0·732	280	0·517
25	0·923	51	0·855	77	0·796	115	0·725	290	0·508
26	0·920	52	0·852	78	0·794	120	0·714	300	0·500
27	0·917	53	0·850	79	0·792	125	0·706	400	0·429
28	0·915	54	0·847	80	0·789	130	0·698	500	0·375
29	0·912	55	0·845	81	0·787	135	0·690	600	0·333
30	0·909	56	0·843	82	0·785	140	0·682		

NOTE (i)—For *bending moments* caused by an assumed equivalent moving load, L will be equal to the span of the girder. For *shears* it will usually be the distance of the point under consideration from the further support. For *cross girder concentrations* it will usually be twice the interval between the cross girders.

(ii)—In *combined* railway and road or footway bridges, the coefficients of impact for the roadway or footway loads will be half those given in above table.

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE II.

[Chapter VII, Rule 13.]

Permissible Compressive Stresses.

P = stress allowed, in tons per square inch.

L = length in inches, centre to centre of connections.

r = least radius of gyration, in inches.

$\frac{L}{r}$	Riveted Ends. P.	Pin Ends. P.	$\frac{L}{r}$	Riveted Ends. P.	Pin Ends. P.	$\frac{L}{r}$	Riveted Ends. P.	Pin Ends. P.
10	7·75	7·6	48	6·8	6·08	86	5·85	4·56
12	7·7	7·52	50	6·75	6·0	88	5·8	4·48
14	7·65	7·44	52	6·7	5·92	90	5·75	4·4
16	7·6	7·36	54	6·65	5·84	92	5·7	4·32
18	7·55	7·28	56	6·6	5·76	94	5·65	4·24
20	7·5	7·2	58	6·55	5·68	96	5·6	4·16
22	7·45	7·12	60	6·5	5·6	98	5·55	4·08
24	7·4	7·04	62	6·45	5·52	100	5·5	4·0
26	7·35	6·96	64	6·4	5·45	102	5·45	3·92
28	7·3	6·88	66	6·35	5·26	104	5·4	3·84
30	7·25	6·8	68	6·3	5·28	106	5·35	3·76
32	7·2	6·72	70	6·25	5·2	108	5·3	3·68
34	7·15	6·64	72	6·2	5·12	110	5·25	3·6
36	7·1	6·56	74	6·15	5·04	112	5·2	3·52
38	7·05	6·48	76	6·1	4·96	114	5·15	3·44
40	7·0	6·4	78	6·05	4·88	116	5·1	3·36
42	6 95	6·32	80	6·0	4·8	118	5·05	3·2
44	6·9	6·24	82	5·95	4·72	120	5·0	3·28
46	6·85	6·16	84	5·0	4·64	...	...	...

NOTE (i)—The above table is based upon the following formulæ :—

$P = (8 - 0{\cdot}25 \frac{L}{r})$ for *riveted* ends.

$P = (8 - 0{\cdot}04 \frac{L}{r})$ for *pin* ends.

(ii)—The above stresses are for steel of the quality assumed in Rule 10, *i.e.*, for which 8 tons per square inch is permissible for direct tensile stress.

(iii)—For wrought-iron 75 per cent. of the above stresses may be used.

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE III.

[Chapter VII, Rule 15.]

Standard equivalent Uniform Load in tons per foot of each track,

to be used for calculating Bending Moments.

(*Standard B of 1903.*)

Effective span in feet.	5′ 6″ Gauge.		Metre gauge.		Effective span in feet.	5′ 6″ Gauge.		Metre gauge.	
	Total load.	Load per foot.	Total load.	Load per foot.		Total load.	Load per foot.	Total load.	Load per foot.
5	36	7·200	20·0	4·000	60	126	2·093	87·5	1·458
6	36	6·000	21·3	3·550	62	129	2·077	89·7	1·447
7	36	5·143	22·6	3·229	64	132	2·063	91·9	1·436
8	36	4·500	23·9	2·988	66	135	2·049	94·1	1·426
9	36	4·000	25·2	2·800	68	138	2·035	96·3	1·416
10	36	3·600	26·5	2·650	70	142	2·023	98·5	1·407
11	39·5	3·591	27·8	2·527	72	145	2·011	101	1·399
12	42·5	3·542	29·1	2·425	74	148	2·000	103	1·391
13	45·2	3·477	30·4	2·338	76	151	1·989	105	1·384
14	47·8	3·414	31·7	2·264	78	154	1·979	107	1·377
15	50·2	3·347	33·0	2·200	80	158	1·970	110	1·369
16	52·4	3·275	34·3	2·144	82	161	1·961	112	1·361
17	54·5	3·206	35·6	2·094	84	164	1·952	114	1·352
18	56·5	3·139	36·9	2·050	86	167	1·943	116	1·343
19	58·5	3·079	38·2	2·011	88	170	1·934	118	1·335
20	60·4	3·020	39·4	1·970	90	173	1·926	120	1·328
21	62·2	2·962	40·7	1·938	92	177	1·918	121	1·320
22	64·0	2·909	42·0	1·909	94	180	1·910	123	1·312
23	65·7	2·857	43·3	1·882	96	183	1·902	125	1·304
24	67·4	2·808	44·5	1·854	98	186	1·895	127	1·297
25	69·1	2·764	45·7	1·828	100	189	1·888	129	1·290
26	70·8	2·723	47·0	1·808	105	196	1·868	133	1·270
27	72·5	2·685	48·3	1·789	110	204	1·850	138	1·251
28	74·2	2·649	49·6	1·771	120	218	1·816	146	1·218
29	75·8	2·614	50·8	1·752	130	232	1·788	155	1·188
30	77·4	2·580	52·0	1·733	140	246	1·760	163	1·163
31	79·0	2·548	53·2	1·716	150	260	1·733	171	1·140
32	80·6	2·519	54·4	1·700	160	273	1·706	179	1·119
33	82·2	2·491	55·6	1·685	170	286	1·681	187	1·100
34	83·8	2·465	56·8	1·671	180	298	1·658	195	1·083
35	85·4	2·440	58·0	1·657	190	311	1·637	203	1·068
36	87·0	2·417	59·2	1·644	200	323	1·617	211	1·055
37	88·6	2·395	60·4	1·632	210	336	1·598	219	1·043
38	90·2	2·374	61·6	1·621	220	347	1·579	227	1·032
39	91·8	2·354	62·8	1·610	230	359	1·562	235	1·022
40	93·4	2·335	64·0	1·600	240	371	1·546	243	1·012
41	95·0	2·317	65·2	1·590	250	383	1·530	251	1·004
42	96·6	2·300	66·4	1·581	260	395	1·517	259	0·996
43	98·2	2·284	67·6	1·572	270	406	1·504	267	0·989
44	99·8	2·268	68·8	1·564	280	418	1·492	275	0·982
45	102	2·254	70·0	1·556	290	430	1·482	282	0·972
46	103	2·241	71·2	1·548	300	442	1·473	289	0·963
47	105	2·228	72·4	1·541	325	471	1·449	309	0·949
48	106	2·215	73·6	1·534	350	500	1·429	328	0·937
49	108	2·202	74·8	1·527	375	529	1·411	348	0·927
50	110	2·190	76·0	1·520	400	558	1·395	367	0·918
52	113	2·169	78·3	1·506	425	587	1·381	387	0·911
54	116	2·148	80·6	1·493	450	616	1·369	406	0·902
56	119	2·129	82·9	1·481	475	645	1·358	426	0·896
58	122	2·110	85·2	1·469	500	674	1·348	445	0·890

NOTE (i)—For purposes of comparison the load equivalent to any train may be calculated either by the method given in the Bulletin of the International Railway Congress, August 1901 (also in Technical Section Paper No. 121) for moments at the *sixth* point of span, or by actual wheel-loads.

(ii)—For spans below 35 feet the maximum moment, wherever it occurs, is to be taken as the centre ordinate to the parabola of uniform load, as the girders will usually be of uniform section.

(iii)—In this Table L is the *effective*, not the clear, span, *i.e.*, the span between centre to centre of bearings.

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE IV.

[Chapter VII, Rule 15.]

Standard equivalent Uniform Load in tons per foot of each track,

to be used for calculating Shears.

(Standard B of 1903.)

L in feet.	Load per foot.		L in feet.	Load per foot.	
	5′ 6″ gauge.	Metre gauge.		5′ 6″ gauge.	Metre gauge.
5	7·200	4·320	60	2·346	1·577
6	6·500	4·067	62	2·322	1·565
7	5·942	3·800	64	2·300	1·552
8	5·500	3·575	66	2·278	1·540
9	5·156	3·400	68	2·258	1·528
10	4·880	3·240	70	2·240	1·517
11	4·654	3·109	72	2·222	1·505
12	4·466	2·983	74	2·204	1·492
13	4·292	2·877	76	2·188	1·479
14	4·142	2·790	78	2·172	1·466
15	4·014	2·667	80	2·156	1·453
16	3·900	2·576	82	2·142	1·440
17	3·802	2·495	84	2·126	1·427
18	3·712	2·424	86	2·112	1·414
19	3·622	2·360	88	2·098	1·402
20	3·540	2·303	90	2·084	1·391
21	3·466	2·251	92	2·072	1·380
22	3·400	2·205	94	2·060	1·371
23	3·340	2·162	96	2·048	1·360
24	3·282	2·123	98	2·036	1 350
25	3·224	2·086	100	2·024	1·340
26	3·170	2·052	105	1·998	1·318
27	3·118	2·021	110	1·973	1·297
28	3·072	1·992	120	1·928	1·261
29	3·028	1·965	130	1·888	1·230
30	2·986	1·940	140	1·850	1 203
31	2·948	1·917	150	1·817	1·180
32	2·912	1·894	160	1·786	1·159
33	2·878	1·874	170	1·759	1·141
34	2·848	1·854	180	1·733	1·124
35	2·818	1·837	190	1·711	1·108
36	2·788	1·819	200	1·689	1·095
37	2·762	1·803	210	1·370	1·083
38	2·736	1·787	220	1·652	1·072
39	2·710	1·773	230	1·635	1·062
40	2·686	1·759	240	1·619	1·052
41	2·662	1·746	250	1·605	1·043
42	2·638	1·733	260	1·592	1·035
43	2·618	1·721	270	1·579	1·028
44	2·598	1·709	280	1·567	1·021
45	2·578	1·698	290	1·556	1·014
46	2·558	1·688	300	1·545	1·008
47	2·538	1·678	325	1·522	0·995
48	2·520	1·668	350	1·502	0·983
49	2·504	1·658	375	1·484	0·973
50	2·488	1·649	400	1·468	0·964
52	2·454	1·633	425	1·454	0·956
54	2·424	1·617	450	1·441	0·949
56	2·396	1·603	475	1·429	0·943
58	2·370	1·590	500	1·419	0·937

L = Loaded length in feet which produces the *Maximum shear* in the member under consideration

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE V.

[Chapter VII, Rule 15.]

Standard Cross Girder Reactions, in tons.

(Standard B of 1903.)

Distance apart of Cross Girders, centre to centre, in feet.	Reaction in tons.	
	5′ 6″ gauge.	Metre gauge.
8	26·2	17·2
9	28·3	18·5
10	30·2	19·7
11	32·0	21·0
12	33·7	22·2
13	35·4	23·5
14	37·1	24·8
15	38·7	26·0
16	40·3	27·2
17	41·9	28·4
18	43·5	29·6
19	45·1	30·8
20	46·7	32·0
21	48·3	33·2
22	49·9	34·4
23	51·6	35·6
24	53·2	36·8
25	54·8	38·0
26	56·4	39·2
27	58·0	40·3
28	59·6	41·5
29	61·2	42·6
30	62·8	43·8
31	64·4	44·9
32	66·0	46·0
33	67·6	47·1
34	69·2	48·2
35	70·8	49·3

NOTE (i)—This Table is derived from the Load specified in Table III according to the formula $R = \frac{2M}{S}$

where S = spacing of the cross girders in inches.
M = maximum bending moment on the stringer, considered as of span 2 S.
R = reaction at middle point of said stringer.

(ii)—Half of the reaction given in this Table is to be considered as applied at each point where a rail-bearer rests on the cross girder.

VII.—Rules for the Design and Inspection of Girder Bridges.

TABLE VI.

[Chapter VII, Rule 18.]

Weights and Dimensions of various kinds of Roadway Loads.

Authority.		DIMENSIONS OF ONE UNIT.				MAXIMUM WEIGHT OF ONE UNIT.		AVERAGE WEIGHT.			Span on which infantry in file produce a greater stress.
		Over All.		Base.				Per foot run of track.	Per square foot.		
		Length.	Width.	Wheel base.	Width of track.	Total.	Maximum on one wheel or foot.		Of base.	Of deck occupied.	
		Feet.	Feet.						lbs.	lbs.	
Part A, from Roorkee Treatise, 1877, Volume III, page 290, and Military Engineering, 1902, Part III, pages 7 to 10.	Unarmed men walking freely	3	1½	...	...	160 lbs.	160 lbs.	53	...	36	...
	„ „ „ crowded	1¼	1	...	...	160 „	160 „	133	...	133	...
	Infantry in marching order in single file.	3	3	...	...	200 „	200 „	67	...	22	...
	Infantry in marching order in file crowded.	..	...	...	...	...	...	280	...	133	...
	Infantry in marching order in fours crowded.	...	...	...	...	...	...	560	...	133	...
	Cavalry in single file marching	12	6	...	...	1,400 lbs.	...	116	...	20	...
	„ „ half-sections crowded	12	8	...	...	...	...	392	...	50	...
	Elephants, unloaded	11	5	6½	...	50 cwt.	30 cwt.	...	...	102	...
	„ loaded	11	9	6½	...	72 „	44 „	...	...	82	...
	Camels, loaded	10	7	4½	...	15 „	10 „	112	...	24	...
	Pack bullocks, loaded	5	2¾	3½	...	5½ „	3½ „	79	...	45	...
	Commissariat cattle crowded	...	...	...	...	4 „	...	...	...	50	...
	Note.—Loaded camels require 10 feet clear width and 11 feet clear headway. Elephants „ 12 feet „ „ „ 15 feet „ „										
Part B, from "The Engineer," Vol. XCV, page 616, dated 19th June 1903.	Steam rollers, 15-tons	19′ 7″	7′ 3″	11′ 6″	7′ 3″	15 tons	5 tons	15 cwt.	403	235	...
	„ „ 20 „	20′ 3″	8′ 3″	11′ 8″	8′ 0″	20 „	6¾ „	20 „	482	268	...
	Traction engine, 11-tons	18′ 4″	7′ 10″	10′ 7″	...	11 „	...	12 „	305	176	...
	„ „ 22 „	...	9′ 7″	15′ 0″	...	22 „	8 tons	...	342	...	...
	Tramcars double, deck, four-wheeler.	27′ 5″	7′ 0″	6′ 0″	5′ 0″	11¾ „	3 „	9 „	893	137	...
	Tramcars double, deck, bogie	33′ 6″	7′ 1″	13′ 6″	5′ 0″	14½ „	2¾ „	8¾ „	497	139	...
	„ „ „ „	35′ 0″	7′ 0″	16′ 0″	5′ 0″	17¾ „	2¼ „	10 „	496	159	...
	„ single „ „	35′ 0″	7′ 0″	17′ 0″	5′ 0″	15 „	3 „	8½ „	380	138	...
	Boiler wagon	...	...	13′ 0″	...	48 „	12 „	...	1,170	...	...
	„ „	...	...	22′ 0″	...	38 „	9½ „	...	...	...	...
	Stone „	...	6′ 8″	9′ 0″	...	16 „	4 „	...	600	...	...
Part C, from Military Engineering, 1902, Part III, pages 11-13.	*Siege and Heavy Artillery.*										
	B. L., 6-inch, 30 cwt. howitzer, with limber.	...	6′ 8″	8′ 6″	5′ 2″	85 cwt.	35 cwt.	...	217	...	...
	Q. F., 4·7-inch on travelling carriage, with limber.	...	6′ 10″	9′ 2″	5′ 2″	88½ „	37 „	...	209	...	...
	Q. F., 4·7-inch on travelling carriage, converted with limber.	...	6′ 7″	10′ 2″	5′ 2″	101½ „	43 „	...	217	...	...
	Field Artillery.										
	B. L., 15-pr., marks III and III, with limber.	...	6′ 2″	8′ 1″	5′ 2″	38 cwt.	10 cwt.	...	102	...	...
	B. L., 12-pr., mark I, with limber	...	6′ 2″	9′ 0″	5′ 2″	33 „	9 „	...	80	...	...
	Q. F., 15-pr., mark I „ „	...	6′ 8″	10′ 3″	5′ 2″	35 „	10 „	...	74	...	...
	Ordnance wagons, &c.										
	Ammunition, B. L., 5″ howitzer, with limber.	...	6′ 2″	7′ 3″	5′ 2″	46 cwt.	12 cwt.	...	138	...	...
	Ammunition, Q. F., 15-pr., with limber.	...	6′ 8″	7′ 5″	5′ 2″	37 „	11 „	...	109	...	...
	Ammunition and store, with pole, mark II.	...	6′ 2″	6′ 0″	5′ 2″	62 „	...	...	224	...	...
	G. S. wagon	...	...	...	5′ 9″	49 „	...	...	132	...	...
	Pontoon wagon	...	6′ 9″	10′ 0″	5′ 10″	48 „	...	...	93	...	27′ 6″
	Ambulance wagon, mark V	...	6′ 2″	7′ 1″	5′ 2″	38 „	...	...	127	...	23′ 6″
	Bakery wagon	...	6′ 3″	6′ 5″	5′ 2″	67 „	...	...	227	...	47′ 6″
	Bread and meat wagon	...	6′ 3″	6′ 5″	5′ 2″	70 „	...	...	237	...	51′ 6″
	Small arm ammunition cart	...	6′ 6″	...	5′ 2″	22 „	22 cwt.	...	...	...	17′ 6″
	Steam sapper, 6 H. P.	...	5′ 9″	7′ 2″	5′ 9″	117 „	43 „	...	318	...	94′ 0′
	„ „ 8 H. P.	...	7′ 3″	10′ 5″	7′ 3″	251 „	95 „	...	373	...	193′ 0′
	Traction engine	...	7′ 11″	10′ 4″	7′ 5″	240 „	90 „	...	351	...	...
	„ „	...	8′ 3″	11′ 0″	8′ 3″	300 „	120 „	...	359	...	...
	Tender for do.	...	6′ 10	7′ 0″	5′ 4″	178 „	45 „	...	534	...	...

Part D, calculated in Technical Section.

Equivalent uniform load on various spans.	Total load on span in tons.								
Span	5	10	15	20	30	40	60	100	150 feet.
Line of Q. F. 4·7-inch guns drawn by 16 bullocks each.	8·6	8·6	8·8	9·0	9·6	10·4	11·4	16·0	22·5 tons.
Traction engine (20 tons) drawing train 5 cwt. per l. ft.	32·0	32·2	32·5	32·8	33·3	33·2	33·6	35·0	37·5 „

Note.—These equivalent loads only apply to members of a bridge which carry roadway load only. For those which carry combined train and road load, see Rule 17.

They apply directly to loads on longitudinal girders. For loads on cross girders, take half the load shown in the table for a span equal to double the distance between the cross girders.

Forms for Tabulated Details, etc.

Form I.

Gonda-Azimgarh Railway.
(5 ft. 6 in. gauge.)
(152·36 miles.)

CURVE ABSTRACT.

DEGREE OF CURVATURE, OR RADIUS.	NUMBER OF EACH.	TOTAL LENGTH. — Miles.	TOTAL CURVATURE. — Degrees.
(FORM FOR 5 FT. 6 IN. GAUGE.)			
4°—20′ (R.=1,322 feet)	*2*	*0·32*	*72°·4*
4°—0′ (R.=1,432 feet)	*1*	*0·17*	*36°·0*
3°—20′ (R.=1,719 feet)	*7*	*1·06*	*177°·7*
3°—0′ (R.=1,910 feet)	*17*	*3·10*	*491°·0*
2°—0′ (R.=2,865 feet) up to 2°—59′	*43*	*8·71*	*987°·9*
1°—0′ (R.=5,730 feet) up to 1°—59′	*58*	*15·81*	*948°·0*
Flatter than 1°—0′	*16*	*2·82*	*116°·5*
TOTAL	*144*	*31·99*	*2,829°·5*

Ratio of curve to total length of line—21 per cent.

Average amount of curvature per mile—18·7 degrees.

(FORM FOR METRE GAUGE.)			
6°—40′ (R.=859 feet)	*2*	*0·34*	*120°·0*
6°—0′ (R.=955 feet)	*1*	*0·15*	*48°·0*
5°—30′ (R.=1,042 feet)	*6*	*0·80*	*214°·5*
5°—0′ (R.=1,146 feet)	*9*	*1·20*	*316°·0*
4°—0′ (R.=1,432 feet) up to 4°—59′	*13*	*1·73*	*365°·0*
3°—0′ (R.=1,910 feet) up to 3°—59′	*17*	*3·10*	*491°·0*

Rest of form same as for 5 ft. 6 in. gauge.

JAMES THOMSON,
Manager.

AZIMGARH:
15th October 1893.

NOTE.—For all curves of 3°—0′ or sharper on 5 ft. 6 in. gauge or of 5°—0′ or sharper on metre gauge, the actual degree of curvature, length, etc., are to be shown as in the forms above. Below these limits the curves may be classed as above

Form II.

Gonda-Azimgarh Railway.

(5 ft. 6 in. gauge.)
(152·36 miles.)

GRADIENT ABSTRACT.

INCLINATION.	NUMBER OF EACH.	TOTAL LENGTH. — Miles.	PERCENTAGE OF TOTAL LENGTH OF LINE.
1 in 50, or 2 per cent.	*3*	*2·12*	*1·39*
1 in 67, or 1·5 per cent.	*13*	*7·21*	*4·73*
1 in 80, or 1·25 per cent.	*6*	*3·64*	*2·39*
1 in 100, or 1 per cent.	*23*	*9·05*	*5·95*
1 in 101 to 1 in 150 or 0·67 per cent.	*16*	*7·72*	*5·07*
1 in 151 to 1 in 200, or 0·5 per cent.	*47*	*16·53*	*10·85*
1 in 201 to 1 in 300, or 0·33 per cent.	*25*	*11·40*	*7·48*
1 in 301 to 1 in 500, or 0·2 per cent.	*82*	*23·27*	*15·27*
1 in 501 to 1 in 1,000, or 0·1 per cent.	*103*	*41·35*	*27·14*
Flatter than 1 in 1,000, including level	...	*30·07*	*19·73*
TOTAL	...	*152·36*	*100·00*

The longest continuous grade of 1 in 50 extends for 0·93 miles, followed by a grade of 1 in 67 for 1·26 miles.

All grades of 150 or steeper are confined to the length between miles 14 and 47.

AZIMGARH ;
15th October 1893.

JAMES THOMSON,
Manager.

NOTE.—For all grades of 1 in 100 or steeper, the *actual* inclination, length, etc., are to be shown as in the form above; grades below this limit may be classed as above.

Form III.

Gonda-Azimgarh Railway.
(5 ft. 6 in. gauge.)
(152·36 miles.)

BRIDGE ABSTRACT.

TYPE OF BRIDGE.		Total Number of Spans.	Waterway. lin. ft.
CLASS.	SPANS.		
Open tops	*2 feet*	*72*	*144*
Flat tops	*2 feet*	*168*	*336*
Arched Culverts	*3 feet*	*234*	*702*
	6 feet	*222*	*1,332*
	12 feet	*94*	*1,128*
	18 feet	*3*	*54*
Girder Bridges	*6 feet*	*32*	*192*
	12 feet	*56*	*672*
	20 feet	*97*	*1,940*
	40 feet, 12 of one span	*12*	*480*
	,, 4 of three spans	*12*	*480*
	150 feet, 1 of six spans	*6*	*900*
	,, 1 of eight spans	*8*	*1,200*
	TOTAL FOR WHOLE LINE	...	*9,560*
	AVERAGE PER MILE	...	*62·7*

This does not include irrigation channels up to 12 inches diameter.

AZIMGARH;
15th October 1893.

JAMES THOMSON,
Manager.

NOTE.—For bridges of less than 40 feet span, only the total number of openings of each span need be given for 40 feet span and over, the number of separate bridges and the number of spans in each should also be given.

Form IV.

Gonda-Azimgarh Railway.
(5 ft. 6 in. gauge.)
(152·36 miles.)

IMPORTANT BRIDGES.

(For bridges having a total waterway of 1,200 square feet or upwards.)

NAME OF RIVER.	Mileage.	Drainage area.	Rise of ordinary flood above low water.	Slope of bed per mile.	Mean velocity in flood per second.	Sectional area in flood.	Discharge per second.	Span.		Height of under side of girders.		Average depth of founds below low water level.
										Above low water.	Above flood level.	
		Sq. Miles.	Feet.	Feet.	Feet.	Sq. feet.	Cub. feet.	Feet.	No.	Feet.	Feet.	Feet.
Ramganga	5	5,935	19	1·3	6·9	21,954	151,483	150	8	31	12	60
	About one-half of the area drained by the Ramganga is under cultivation, the remainder being pasture and waste. The average rainfall over the district in the year is about 42 inches and the maximum registered at any station in 24 hours is 9 inches, which record was obtained at Rajgarh on 12th July 1876, when the river rose to 18·7 feet above low water. The soil is chiefly sandy loam overlying sandstone which crops out on the surface occasionally.							*Wells, 16 feet diameter, of brickwork hearted with concrete, two to each pier, sunk to stiff clay at an average depth of 60 feet below low water level. Rails between girders. Single line. Cart road on upper booms, floored and ballasted.*				
Bangsaara	109	4,880	13	1·7	6·3	18,980	119,574	150	6	33	20	20
	The area drained by the Bangsdara is chiefly covered with forest which probably acts to a great extent as a flood moderator. The rainfall is said to be occasionally very heavy, but there is no rain-gauge station in the district. In the cyclone of 1876 the river is reported to have risen to 14·3 feet above low water, but ordinary heavy floods are from 12 to 13 feet above low water.							*Masonry. Open foundations, 20 feet below low water level, on rock. Rails above girders. Single line. Decked and ballasted at rail level for cart traffic.*				

Azimgarh;
15th October 1893.

James Thomson,
Manager.

Form V.

Gonda-Azimgarh Railway.

(5 ft. 6 in. gauge.)
(152·36 miles.)

BALLAST AND PERMANENT-WAY.

The Permanent-way consists of steel flat-footed rails, weighing 82 lbs. per yard, 30 feet long with a small percentage of 27 and 24 feet. They are 5¼ in. deep, the head is 2½ and the foot 4½ in. wide, and the fishing planes are inclined at an angle of 1 in 4 with the base.

The fishplates weigh 48 lbs. a pair, and are 22 inches long with 4 holes spaced 6½, 5 and 6½ inches centres.

The bolts are ⅞ in. diameter with square necks and cup-shaped heads, the nuts hexagonal, 1½ in. over flats and 1⅛ in. deep without washers.

The sleepers between Gonda and Banda are of deodar, 9 ft. 6 in. by 10 in. by 5 in., eleven to each 30-foot rail. Each rail is secured to each sleeper by two dogspikes 5 in. under head and ⅝ in. square except at the joints where two spikes on the outside and one coach-screw ¾ in. diameter by 5¼ in. long on the inside of each rail are used.

Bearing plates 6½ by 7½ inches are used on all bridge timbers and on every sleeper under the outer rail of all curves of 3° deflection or sharper, but not elsewhere, except on two experimental lengths of half a mile each, where they are used on every sleeper. Where these are used, the rail is secured by one spike on the straight or two on curves on the outside, and one coach-screw on the inside.

Between Banda and Azimgarh the sleepers are cast-iron bowls 1 ft. 11 in. diameter weighing about 90 lbs. each with tie-bars 2 inches by ½ inch secured by gibs and cottres.

The inner edge of the rail foot is held by a lug on the sleeper, and the outer edge by a steel key.

There are eleven sleepers to each 30-foot rail.

The ballast consists of broken stone, except in a few short lengths between Banda and Azimgarh, where shingle is used. On the ghat section 18 cub. ft. per foot run has been laid throughout except on a few banks where the minimum is 10 cub. ft. per foot. Between miles 21 and 70 the minimum at present is 6 cub. ft. per foot, but on the rest of the length in no case is there less than 10 cub. ft.

The full section of 16 cub. ft. is laid on the approaches of all bridges and will be completed throughout by the middle of July next.

AZIMGARH:
5th October 1893.

JAMES THOMSON,
Manager.

Form VI.

Gonda-Azimgarh Railway.
(5 ft. 6 in. gauge.)
(152·36 miles.)

STATION BUILDINGS.

NAME OF STATION.	Class.	Mileage.	Distance apart.	Station Building.	Goods Shed.	Passenger Platform. Length.	Passenger Platform. Height above rails.	Goods Platform. Length.	Station Master's Quarters. No.	Station Master's Quarters. Sq. feet.	Assistant Station Master or Signaller's Quarters. No.	Assistant Station Master or Signaller's Quarters. Sq. feet.	Menials' Quarters. No.	Menials' Quarters. Sq. feet.	Staff Well (c) Diam.
			Miles.	Sq. feet.	Sq. feet.	Feet.	Feet.	Feet.							Feet.
Gonda	2	0		3,120	3,200	(b)	—	400	1	4,280	4	2,560	12	1,680	—
Dharampur	3	12 3/8	12 3/8	1,630	—	600	1	—	1	1,200	2	1,280	6	840	6
Salwan	3	23 1/4	10 7/8	1,630	—	600	—	—	1	1,200	2	1,280	6	840	—
Shahpur (a)	3	38 1/4	15	1,630	—	600	1	—	1	1,200	2	1,280	6	840	6
Nawabganj (a)	2	54 5/8	16 3/8	1,630	1,800	600	2 3/4	300	2	2,400	2	1,280	8	1,120	—
Musani (a)	3	73	18 3/8	1,630	—	600	1	—	1	1,200	2	1,280	6	840	—
Mandwal (a)	3	87 3/4	14 3/4	1,630	—	—	—	—	1	1,200	2	1,280	6	840	6
Bishanpur (a)	3	101 1/4	13 1/2	1,630	—	600	1	—	1	1,200	2	1,280	6	840	6
Banda	2	111 1/8	9 7/8	2,460	3,200	600	2 3/4	400	2	6,460	4	2,560	12	1,680	—
Shergarh	3	120	8 7/8	1,520	—	600	1	—	1	1,200	2	1,280	6	840	6
Gujran	3	130 1/2	10 1/2	1,520	1,800	600	2 3/4	300	1	1,200	3	1,920	8	1,120	—
Kheri	3	139 1/2	9	1,520	—	600	1	—	1	1,200	2	1,280	6	840	6
Azimgarh	1	152 1/4	12 3/4	4,380	5,400	600	2 3/4	400	2	6,460	4	2,560	16	2,240	—

(a) The section is graded to admit of stations being put in at miles 29 3/4, 45 3/8, 62 1/4, 79 and 93 1/4.
(b) Existing platform at Gonda will be used.
(c) Only wells provided specially for the use of the staff are to be entered on this Form.

Azimgarh;

James Thomson,
Manager.

Form VII.

_____ RAILWAY.

QUARTERS FOR STAFF.

Serial No.	Reference to Type.		DESCRIPTION OF STAFF QUARTERS.			COST OF STAFF QUARTERS.			CLASS OF OCCUPANTS FOR WHOM INTENDED.				RENT FOR WHOLE BLOCK LEVIABLE UNDER THE RULES OF THE RAILWAY.					Remarks.
				Number of units in one block.		Cost of one block.		Total cost, excluding tools and establishment and share of land.					℟ per mensem.			Probable rent to be actually charged to probable occupants (*d*) ℟ per annum.	Percentage of probable actual annual rent to total cost. (per cent.)	
	Type No.	Drawing No.	Name or class.	Single.	Married.	Main building. ℟	Out-houses. ℟	℟	No.	Probable rate of monthly salary of each occupant, ℟ (per mensem.)	Probable total annual salary of all occupants ℟ (per annum.)	Percentage of total annual salary of occupants to total cost of block. (per cent.)	(*a*) by cost.	(*b*). by area.	(*c*) by pay.			
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19

NOTE—The entries in columns 14, 15, 16 and 17 will vary according to the Rent Rules of the Railway concerned.
For State Railways (*a*) Column 14 should be calculated according to Public Works Department Code, Vol. I, para. 1068 I (*a*) and Vol. IV, Chap. III, para. 2·5.
(*b*) „ 15 „ „ „ „ „ Vol. IV, Chap. III, para, 218 *e* & *f*.
(*c*) „ 16 „ „ „ „ „ Vol. I, para. 1068 I (*b*) and Vol. IV, Chap. III, para. 218 *f* & *g*.
(*d*) „ 17 will be *nil* for subordinates referred to in Public Works Department Code, Vol. IV, Chap. III, para. 228 only.
Columns 10 to 13, and 17, 18 should be invariably filled up ; but of columns 14, 15, and 16 only those applicable to the particular class of Staff Quarters referred to need be filled.

Form VIII.

Gonda-Azimgarh Railway.
(5 ft. 6 in. gauge.)
(152·36 miles.)

STATION MACHINERY.

NAME OF STATION.	Station ashpits.	Water columns.		Piping.		Water-tank	Well. (a)	Steam-pumps.	Hand-pumps or water lifts.	Switches.			Crossings.				Home Signals.	Outer Signals.	Weigh-bridges.		Engine Shed.	Locomotive ashpits.	Engine Turntables.
		Number.	Diameter.	Length.	Diameter.	Capacity.	Diameter.			15 feet.	12 feet.	Total.	1 in 12.	1 in 8½.	1 in 6.	Total.			Number.	Capacity.	Area.		
	No.	No.	Inches.	Feet.	Inches.	Cub feet.	Feet.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	Tons	Sq. feet.	No.	No.
GONDA	2	1	6	620	6	3,072	16	1*	—	4	4	8	4	4	—	8	2	3	1	30	5,280	3	1
Dharampur	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Salwan	1	1	8	110	8	1,200	12	—	1	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Shahpur	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Nawabganj	1	1	8	110	8	1,200	12	—	1	4	3	7	4	2	1	7	2	2	1	22	—	—	—
Musani	1	1	8	110	8	1,200	12	—	1	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Mandwal	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Bishanpur	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
BANDA	2	2	6	836	6	3,072	16	1†	—	4	8	12	4	6	2	12	2	2	1	30	5,280	4	1
Shergarh	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
Gujran	1	1	8	110	8	1,500	16	—	1	2	5	7	2	4	1	7	2	2	—	—	—	—	—
Kheri	—	—	—	—	—	—	—	—	—	2	1	3	2	—	1	3	2	2	—	—	—	—	—
AZIMGARH	1	1	6	842	6	3,072	16	1*	—	4	7	11	4	5	2	11	2	1	2	30 22	5,280	2	1
TOTAL	9	8	—	2,738	—	14,316	No. 7 (a)	3	4	34	35	69	34	21	14	69	26	26	5	—	15,840	9	3

AZIMGARH;
5th October 1893.

(a) Not including wells for staff only.
* 8 Horse power.
† 6 Horse power.

JAMES THOMSON,
Manager.

Form IX.

_____RAILWAY.
_____GAUGE.
Length _____miles.

LIST OF QUESTIONS AND ANSWERS.

This document should be prepared, in the first instance, by the Chief Officer of the Agency which *constructed* the new railway; it should be carefully scrutinised by the Government Inspector in the course of his inspection, and any corrections found necessary should be carried out. The document should be countersigned, before its submission to the Government of India, by both the Government Inspector and the Chief Officer of the Agency which will *work* the new railway.

	Questions.		Answers.
	Formation, Earthwork, etc.		
1	Have any special precautions been adopted to ensure the safe working of the line on sharp curves and steep gradients?	1	
2	Have slips in cuttings and embankments been guarded against by the adoption of special precautions?	2	
	Tunnels.		
3	Is additional lining necessary?	3	
4	Do any portions of the sides or roof of any tunnel infringe 'Standard Dimensions'?	4	
5	Have adequate facilities been provided to enable workmen to escape from an approaching train without difficulty?	5	
	Bridges.		
6	Have hand rails or parapets been provided on any of the bridges and is it necessary to provide any more?(*a*)	6	
7	Are the floors, sleepers and bed timbers on bridges adequately protected from fire?	7	
8	Has expansion of bridge girders been adequately provided for by rollers or other means?	8	
9	Are long bridges provided with adequate facilities to enable workmen to escape from an approaching train without difficulty? Have trolly refuges been provided if necessary?	9	
10	Has an adequate cushion of earth been allowed on arched bridges between bottom of ballast and crown of arch?(*b*)	10	
11	Has due care been taken to provide sufficient waterway and to guard against scour?	11	
12	Has sufficient headway been provided for craft plying or likely to ply, on navigable streams?	12	
13	Has information of the nature and depth of the foundations and hidden work in bridges, culverts and other structures likely to be exposed to scour been recorded on the structures themselves?(*c*)	13	

(*a*) As a rule these will seldom be insisted on, except in cases where the bridge is used by the public, or where special circumstances render it desirable to provide a footway clear of the track, and even then they are usually required only on the one side of the bridge on which the footway is provided.

(*b*) A cushion of less than 18 inches is not ordinarily to be recommended for arches of over 10 feet span.

(*c*) *See* Government of India, Public Works Department, letter No. 919 R. C., dated 23rd May 1899, and Director of Railway Construction's letter No. 905 R. C., dated 22nd May 1899.

Form IX.—*contd.*

	Questions.		Answers.
14	Have completion drawings of all important bridges and other structures been prepared as ordered in Public Works Department Code, Volume I, Chapter IX, paragraph 976. Do these contain all information regarding foundations and other hidden work as actually executed. Where are they recorded?	14	
15	Are all bridge girders properly braced?	15	
	Land Boundaries and Fencing.		
16	Have the boundaries of the railway land been properly defined by suitable marks which can be readily found and identified? Have complete and accurate land plans been prepared? Where are they recorded?	16	
17	Has fencing been provided? Is it of efficient design? Are all openings guarded by gates and gate-keepers or other means for preventing cattle straying within the fenced area?	17	
18	Are the station yards fenced ?(*a*)	18	
	Level crossings.		
19	Are there any gates (*b*) which close across the line? Have the following been provided for their safe working?— i. A gate-keeper with a suitable hut. ii. Efficient and simple means of fastening each gate both across the railway and across the road. iii. Proper signals and lamps to show both along the railway and roads.(*c*)	19	
20	Are all gates not intended to close across the line so placed that, whether open or closed, no part thereof can come within a distance of seven feet from the centre line of rails? (This also applies to any hinged bar, chain, or other device intended to be used for closing any road crossing a railway.)	20	
21	Are efficient guard rails, properly spaced, provided at each level-crossing? Is the road made up to rail level?	21	
	Over-bridges.		
22	Is the roadway for the public, over the bridge, of sufficient width and with suitable inclines according to the class of traffic to be accommodated? Are the approaches fenced, where necessary, to prevent accident? In the case of bridges in the neighbourhood of important towns, are they provided with continuous closed parapets of suitable construction and proper height and length so as to prevent horses being frightened by passing trains?	22	
	Mile and Gradient Posts.		
23	Are proper mile and gradient posts provided? Are the telegraph posts numbered, (*d*) and can the figures be read with facility from passing trains?	23	

(*a*) Whether the line generally is fenced or not, it is usually desirable that efficient fencing should be provided round every station yard, and for about a hundred feet of line beyond the station yard at each end. If there is a level crossing at the end of the yard, the fencing should usually be extended up to it. Barbed wire fencing is not usually desirable.

(*b*) The gates should not be made of iron or be otherwise of such substantial character as to be a serious source of danger to a train accidentally running through them.

(*c*) Where a clear view of the gates cannot be had by the driver of an approaching train for a distance of at least a quarter of a mile in each direction, a special self-acting signal should be provided, and so placed as to be visible for that distance.

Special signals and interlocking apparatus should be provided, if necessary, for safe working near large stations or crowded thoroughfares.

(*d*) For example, $\frac{36}{9}$ on a telegraph post would signify a distance of 9 posts beyond mile 36.

Form IX.—*contd.*

	Questions.		Answers.
24	How has the mileage been reckoned? (*a*)	24	
25	Are all changes of gradient marked by gradient posts?	25	
	Ballast and Permanent-way.		
26	What ballast has been provided and is it of good quality and sufficient in quantity?	26	
27	What sleepers have been provided and are they of good quality, of a suitable description, and properly spaced?	27	
28	What rails have been provided and are they properly fished at the joints, and are all fish-bolts in place?	28	
29	To what extent have bearing plates and double spiking been used, and is the further adoption of such safe guards necessary? (*b*)	29	
30	Has proper allowance been made for expansion of rails?	30	
31	Have check rails been provided on sharp curves, and are more necessary?	31	
	Station Buildings, Platforms, etc.		
32	What are the heights of passenger platforms, and the horizontal distance from centre of track to face of platform wall?	32	
33	Are the ends of all platforms ramped, and to what slope?	33	
34	Have 'Standard Dimensions' in stations been observed?	34	
35	Has suitable accommodation for passengers been provided at all stations? Have latrines been provided, and are they properly situated, constructed and lighted? Are there proper arrangements for supplying drinking water?	35	
36	Are foot-bridges or sub-ways for crossing the line provided where necessary? Are any landings provided (*c*) and are the rise and tread of steps properly proportioned?	36	
37	Are hand rails or other suitable protection provided to all high-level platforms, staircases, over-bridges, etc.?	37	
38	Are the names of stations shown, both in English and Vernacular, in large and distinct letters in conspicuous positions, so as to be readily seen by passengers in the trains both by day and night?	38	
39	Are clocks provided at all crossing stations, and are they so placed as to be easily seen by the guards and drivers?	39	

(*a*) In the case of a railway in through communication with a sea port, the mileage should be reckoned from the end which is nearest to that sea port. For a branch line the mileage should generally be reckoned from the same zero as that adopted for the main line but marked by a distinguishing letter.

(*b*) With flat-footed rails and pine sleepers, bearing plates, double spiked outside each rail, should usually be provided on the sleeper next the joint on each side, and on sharp curves under the outer rail on all sleepers. Where hard wood sleepers are used, double spiking only would suffice.

(*c*) If the total height of steps exceeds 15 feet, it is usually desirable that there should be an intermediate landing not less than 4 feet in length.

Form IX.—*contd.*

	Questions.		Answers.
	Signals.		
40	What signals are provided? Are they well constructed, properly fitted and in good working order?	40	
41	Are all semaphore signals so arranged that the signal shall be given by the arm on the left of the post as seen from an approaching train?	41	
42	Are all signals arranged to show 'danger' and 'caution' only?	42	
43	Are all signals arranged to show 'danger' in the event of breakage or failure of the connections?	43	
44	Are all signals so placed as to be plainly visible for a sufficient distance to the driver of an approaching train? Are the outer signals plainly visible from the home signal and from the station platform?	44	
45	Is each signal lamp, situated at a distance from the place from which it is worked, arranged to show a small white light to the signal man when the front spectacle shows "danger," and no light at all under other circumstances?	45	
46	Are the arrangements for working the signals such that the arm cannot be lowered by any alteration in the length of the wire, due to change of temperature?	46	
47	Are the points and signals interlocked, and if so, by what method? Is the apparatus in proper order? Is its working effective, and does it comply with the conditions laid down in Government of India, Public Works Department, Circular No. IX. Ry., dated 18th August 1893, and Circular No. 513 R. S., dated 6th November 1896? (*a*)	47	
	Points and Crossings.		
48	Are the points and crossings of good design and construction, properly laid and fitted, and in good working order?	48	
49	Are all switch handles so placed that the pointsman is exposed to no risk from passing trains? (*b*)	49	
50	Are facing points on the main line or sidings, over which passenger trains may pass, provided with approved automatic locking apparatus (complying with conditions laid down in Public Works Department Circular No. IX Ry., dated 18th August 1893, and Circular No. 513 R. S., dated 6th November 1896,) (*a*), or with arrangements by which the points can be securely fastened in either direction, and locked with a padlock?	50	

(*a*) Revised rules for the condition for Proper Interlocking are under consideration; and, when promulgated, will take the place of the Circulars quoted in Items 47 and 50.

(*b*) As a rule, switch handles should not be placed between two lines of rail; but if so placed, the levers are to be arranged to work parallel to the lines, not at right angles thereto.

Form IX.—*contd.*

	Questions.		Answers.
51	Are points, which are worked from a distance, connected with the lever by rods properly compensated for temperature? (Wires are not to be used for this purpose unless specially sanctioned by the Government of India.) Are such points, when facing, in each case provided with a suitable indicator, visible from the lever, and with a locking bar longer than the greatest distance between any two consecutive wheels or with any other approved devices, and if so, of what pattern?	51	
	Engine-turning and Watering.		
52	Has proper provision been made for turning engines at every engine station or working junction, and at every terminus, whether permanent or temporary? (*a*)	52	
53	Have engine-watering stations been provided at convenient distances? Is the water suitable? Is it necessary to halt trains for water at places other than in station yards?	53	
	Station Yards, etc.		
54	Has siding accommodation, sufficient for the traffic immediately expected, been provided at all stations, with room for future expansion if necessary?	54	
55	Is provision made, whether by scotch-blocks or other means, to prevent vehicles escaping from dead-end sidings? Is the scotch-block or other arrangement so constructed as to lie below rail level when out of use, and is it likely to damage the gear of automatic brakes when in use?	55	
56	What stations are situated on a gradient steeper than 1 in 500? Are there any stations on gradients steeper than 1 in 260, and, if so, what precautions have been taken to prevent accidents, and are any further precautions necessary? (*b*)	56	
57	What safety sidings are provided? Are they suitable? Are any others necessary?	57	
58	Are station yards so arranged that shunting past junctions or level-crossings may be avoided as far as possible? Are shunting necks for goods working provided in large yards where shunting operations cannot otherwise be carried on without interfering with incoming trains?	58	
59	Are proper facilities for interchange of traffic provided at all junctions with foreign lines?	59	
	Ferries, etc.		
60	What ferries (*d*) or floating bridges are provided? Are the accommodation provided, the size and construction of the vessels, the arrangements at the landing places, and everything in connection with the undertaking, suited to the safety of the public and of the servants of the railway?	60	

(*a*) In case of short branch lines this may not be necessary. In such cases tank engines should, if practicable, be used.

(*b*) No station should be constructed, nor any siding join a passenger line, on a steeper gradient than 1 in 260, except where it is unavoidable, and with the previous special permission of the Government of India; nor should a falling grade steeper than 1 in 260 commence nearer a station than 150 feet from the outside facing points unless a slip siding or other arrangement is made or rule enforced sufficient to prevent accidents.

(*c*) At any station situated on or in the immediate neighbourhood of a heavy incline, if the incline be falling *towards* the station, a catch siding—or if the incline be falling *from* the station, a slip siding—should be provided, if necessary, in a suitable position with the points locked over for the siding as their normal position.

(*d*) The sanction of the Government of India is required before any ferry can be established by a railway. See Section 51 of Railways Act IX of 1890.

Form IX.—*concld.*

	Questions.	Answers.
	Rolling-stock.	
61	Is the rolling-stock, of all kinds, sufficient for the probable traffic, and is it of suitable design and construction?	61
62	Do the carriages afford the accommodation prescribed by 'Standard Dimensions' and are they properly ventilated and constructed in a manner suitable for the purpose for which they are required?	62
63	Is the following information noted in a conspicuous position on each vehicle?— i. Passenger carriages—the maximum number of passengers intended to be carried in each compartment of every description of carriage. (*a*) ii. Goods wagons—the tare weight of the empty wagon (including wheels, axles, axle-boxes and springs) and the maximum load, in tons, which the wagon is constructed to carry.	63
64	Are any means provided for communication in passenger trains, between guard and driver, and between the passengers and guard, and if so, of what nature?	64
65	Are continuous foot-boards provided to all coaching vehicles or other suitable means to enable the guard to pass along the train?	65
66	Are cow-catchers provided to all engines running on a line that is not efficiently protected by fencing?	66
	Facilities for booking.	
67	Are suitable arrangements made for the booking of passengers at all stations?	67
68	Are suitable weighing machines provided at all stations?	68
	Rules and Time-tables.	
69	Are time and fare tables placed in a convenient position for inspection by the public at each station? Are these documents clearly printed both in English and in the Vernacular of the district?	69
70	Is a copy of the general rules for regulating the working of the railway available for inspection at every station?	70

(*a*) This information should be in Vernacular as well as English for intermediate and third class carriages.

Form X.

CERTIFICATES TO BE GIVEN BY MANAGER.

I do hereby certify—

i. That the Standard Dimensions for railways in India have in every case been worked to, with the exceptions detailed in the statement herewith annexed.* Also, that the Standard Dimensions will be observed in future, and that no work or structure infringing the Standard Dimensions will hereafter be made or permitted without the special sanction of the Government of India.

ii. That each girder bridge is of such design, dimensions and construction as will enable it to bear the dead load of the structure itself (with flooring, roadway, permanent-way, etc., complete), and in addition thereto, the *equivalents* of the live loads specified in the rules for the design and inspection of girder bridges, without exceeding the maximum permissible stress on the available material in any member or portion of the structure.

iii. That the gross load on any pair of wheels of the Engines and Rolling-stock, now provided for the Railway or hereafter to be used thereon, shall in no case exceed the limits laid down in the Standard Dimensions. Also, that more than two engines shall not, under any circumstances, be allowed at one time on the same track of any bridge.

iv. That every Coaching vehicle constructed or procured for the use of the Railway is, and shall be, provided with continuous foot-boards or other suitable means by which the guard can obtain ready access to any vehicle on a train of such vehicles.

v. That in every Third Class carriage constructed or procured for the use of the Railway, the accommodation provided for each passenger is, and shall be, not less than the following, *viz.*:—

Width of seat	19½ inches.
Depth of seat, edge to back	15 inches.
Floor area	3½ sq. feet.
Cubic capacity	25 cub. feet.

Also that one compartment at least of a Third Class carriage on every train carrying passengers shall be reserved for the exclusive use of females, and if the train is to run for a distance exceeding fifty miles, shall be provided with a closet.

vi. That the Railway shall be worked on the system known as.....
.....in accordance with the regulations prescribed in Section.....of the General Rules for Railways in India.

.....

Manager.

* In the statement showing the cases in which the Standard Dimensions have been infringed, full details for each case must be given, in the form attached (Form XI), with explanation of the necessity for such infringement and a reference to the authority under which it was permitted. If there have been no infringements of the Standard Dimensions, the words, "with the exceptions detailed in the statement herewith annexed," should be omitted or struck out.

Form XI.

_____RAILWAY.

INFRINGEMENTS OF STANDARD DIMENSIONS.

Serial No.	Localities.		Names of structures which infringe.	Prescribed standard dimensions.			Existing actual dimensions.	Amount of infringement.	Reason for infringement, and Remarks.
	District or Section.	Mileage.		Item No.	A.	B.			

Form XII.

_____ RAILWAY.

STATEMENT SHOWING RESULT OF TESTS OF GIRDERS during the Inspection on the _____ 190 .

Name or number of bridge.	Mileage.	Particulars of waterway.		Description of girders.	Particulars showing position in which test was applied.			Standing.		Speed—Miles per hour.		Speed—Miles per hour.			Remarks.
								Deflection.		Deflection.		Deflection.			
		Number of spans.	Length of span in feet.		Number of span counting from——.	Right or left girder.	Top or bottom boom.	In inches.	In terms of span.	In inches.	In terms of span.	In inches.	In terms of span.	Oscillation in inches.	

Form XIII.

_____ RAILWAY.

STATEMENT SHOWING MINOR OR OTHER WORKS OPENED OR CLOSED during the half-year ending _____ 190 .

Nature of work.	Position of work.	Purpose for which required.	Date of opening or closing.	Condition under which authority was given, and standing orders acted on.	Whether inspected prior to opening.	Date of inspection since opening.	Reference from or to Government Inspector.

Form XIV.

LIST OF CODE WORDS AND PHRASES USED IN CONNECTION WITH THE OPENING OF RAILWAYS.

Code words.	Meaning.
Baptism	His Excellency the Governor General in Council is pleased, under Sections 18 and 19 of the Indian Railways Act, to sanction the opening for the public carriage of passengers of.
Barb	His Excellency the Governor General in Council is pleased, under Sections 18 and 25 of the Indian Railways Act, to delegate power to you to sanction the opening for the public carriage of passengers of.
Barefoot	(Please) (to) sanction the opening for the public carriage of passengers of.
Barker	(Please) (to) delegate power to Senior Government Inspector to sanction the opening for the public carriage of passengers of.
Barkless	Under Sections 18 and 19 of the Indian Railways Act.
Barmy	Under Sections 18 and 25 of the Indian Railways Act.
Barometer	Subject to the conditions and restrictions recommended by.
Baron	Subject to such restrictions as you consider necessary.
Baronial	Being observed until such time as.
Barrenly	After further inspection shall order that they may be relaxed or removed in the interests of the public, any such relaxation or alteration being reported to this office for information.